Technical Memorandum

URS

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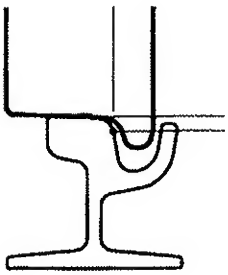
Date: July 25, 2011

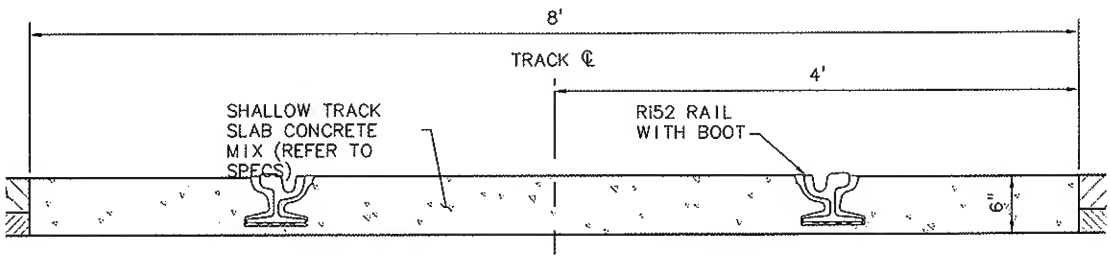
Subject: **Streetcar Rail Flangeway Treatments**

The purpose of this memorandum is to discuss standard practices for installation of in-street embedded streetcar trackway, and potential modifications for minimizing rail flangeway width.

Streetcars systems are designed to operate in existing roadways and other public areas, sharing space with general traffic, cyclists and pedestrians. The trackway needs to accommodate a groove, or flangeway, to allow roadway paving up against the rail while maintaining an opening for streetcar wheel flange passage. The preferred rail design for this application in the United States is known as Ri-52 girder rail. This girder rail has been installed on Seattle's streetcar and light rail transit (LRT) systems. It has a flangeway width of about 1 5/8 inch which is the minimum required for wheel flange clearance in sharp curves, and was specifically designed to meet Americans with Disabilities Act (ADA) Guidelines in the United States.



Girder Rail and Wheel Section



Simplified Streetcar Track Slab Section

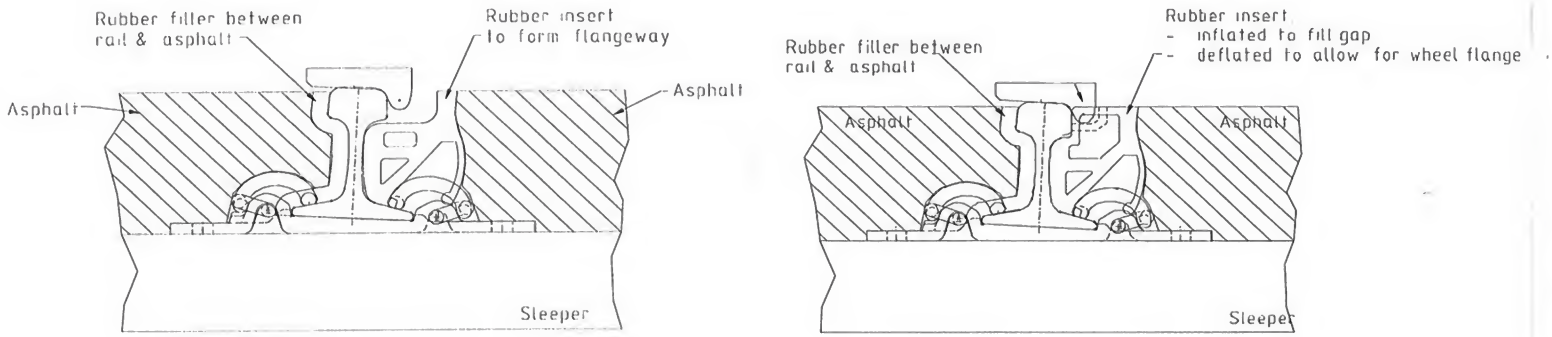
It should be noted that ADA Guidelines allow a flangeway width of up to 2 ½ inches which is the width commonly found in T-rail applications such as light rail transit crossings.

It has been requested that the First Hill Streetcar design team explore options for a potential "flange-filler" design application. There are no standards or products available for closing or narrowing girder rail flangeway. However, there are two types of products available for T-rail.

Flangeway minimizers are commonly used at freight or light rail crossings with high pedestrian traffic such as Amtrak stations. These products can narrow the flangeway to as little as 1 ½ inches, which is only slightly narrower than a standard girder rail flangeway.

Flangeway fillers are commonly used in indoor industrial rail applications such as maintenance facilities, where workers and equipment frequently cross tracks, but rail traffic is minimal. They completely cover the flangeways for ease of crossing the trackway, but the weight of a rail vehicle compresses the filler material to allow its wheels flanges to pass. Flangeway fillers are recommended for indoor use only as they must be kept relatively clean and dry. Buildup of debris and/or icy

conditions can increase the stiffness of flangeway fillers to a point where they will not compress under a rail vehicle's weight, and can cause derailment. They are occasionally used where low-traffic, low-speed freight rail sidings cross roadways at skewed angles. In such applications a derailment would be unlikely to cause injury.



T-Rail Flangeway Treatments

A drawback of T-rail specific flangeway products is that to adapt them to streetcar use would require compromise joints at all girder rail interfaces, and the rail and joints would require unique embedment designs and electrical isolation systems.

A specific case of outdoor use of flangeway filler was brought to light during research for this memo; the Cherry Avenue Bridge in Chicago is a historic railway bridge that was refurbished and converted to a pedestrian and bike-only facility in 2009. Rubber grade crossing panels and flangeway fillers were installed between the existing T-rails to cover the bridge deck while allowing for infrequent, low speed passage of freight engines.

Cherry Avenue Bridge, Chicago

Bridge Deck Detail

While the project has been successful in its goal of creating a good surface for pedestrians and cyclists, its environment is not comparable to that of an active streetcar line.

The Cherry Avenue Bridge is used by only a few trains each year, and only in well controlled conditions. The light, non-motorized traffic on the bridge keeps the deck relatively clean without frequent maintenance.

A manufacturer's representative who supervised the installation of the materials on the bridge said he would not recommend their flangeway filler for in-street use because it was not designed for frequent, higher-speed rail vehicle traffic, or for dirty or freezing conditions. He also said he was aware of no other products designed for this purpose.

In conclusion, there are currently no products available or methods commonly in use that are capable of improving on the standard girder rail design and flangeway width for in-street use on streetcar systems.